EPA/ROD/R03-00/023
2000

EPA Superfund
Record of Decision:

NAVAL SURFACE WARFARE CENTER - DAHLGREN
EPA ID: VA7170024684
OU 15
DAHLGREN, VA
09/28/2000

1.0 THE DECLARATION

1.1 SITE NAME AND LOCATION

Site 3, Ordnance Burn Structure and Site 44, Rocket Motor Pit
Naval Surface Warfare Center Dahlgren Site
Dahlgren, Virginia

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document focuses on remedial decisions and presents the selected remedial actions for Site 3 - Ordnance Burn Structure and Site 44 - Rocket Motor Pit at the Naval Surface Warfare Center Dahlgren Site (NSWCDL) Dahlgren, Virginia, which have been chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for both sites.

The Commonwealth of Virginia concurs with the selected remedy (see Appendix A).

1.3 DESCRIPTION OF THE SELECTED REMEDY

The selected remedies for each site are as follows:

Site 3/44 Soil and Groundwater

No Further Action. Metals-contaminated soils were removed in 1998. Risk analysis conducted after the removal revealed that residual risks to human health and the environment were within acceptable limits.

Risk analysis for groundwater indicated risks are unacceptable; however, Site 3 is not considered the source of the arsenic, 1,1,1-trichloroethane (TCA) and 1,1-Dichloroethene (DCE) driving the risk. The pattern of contaminants detected in the shallow groundwater at Site 3 indicates the contaminant concentrations are attributable to naturally occurring conditions (arsenic) or to Site 12 (TCA and DCE), and are not attributable to Site 3. Site 12 is currently undergoing remediation of these contaminants.

1.4 STATUTORY DETERMINATIONS

The Navy and EPA, in consultation with the Commonwealth of Virginia, have determined that no further remedial action is necessary at Sites 3 and 44. The need for further remedial action has been eliminated by (1) removal of contaminated soil in 1998 and (2) on-going remediation of the source of groundwater, contamination at Site 12.

A 5-year review will be required because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure. The 5-year review for Sites 3 and 44 will be accomplished through the 5-year review for Site 12, the source of groundwater contamination.

1.5 AUTHORIZING SIGNATURES

CAPT. Vaughn E. Mahaffey, USN
Commanding Officer
Naval Surface Warfare Center
Dahlgren, Virginia

9/20/00
Date

Abraham Ferdas, Director
Hazardous Site Cleanup Division
USEPA - Region III

9/28/00
Date

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2.0 DECISION SUMMARY

This Record of Decision (ROD) is issued to describe the U.S. Department of the Navy's (Navy's) and U.S. Environmental Protection Agency's (EPA) selected remedial action for both Site 3 - Ordnance Burn Structure and Site 44 - Rocket Motor Pit, at the NSWCDL, in Dahlgren, Virginia (Figure 2-1). The Commonwealth of Virginia concurs with the selected remedy. Both sites are located at the NSWCDL facility (Figure 2-2). Sites 3 and 44 (hereafter referred to as Site 3/44) are addressed concurrently because 1) of their close proximity and 2) similar types of operations occurred at each site.

2.1 SITE 3/44 - NAME, LOCATION, AND DESCRIPTION

NSWCDL was added to the National Priorities List (NPL) by the Environmental Protection Agency (USEPA) on October 14, 1992. The Navy is the lead agency for site activities and is performing the remedial action under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The USEPA Region III and the Virginia Department of Environmental Quality (VDEQ) are the support agencies for site activities.

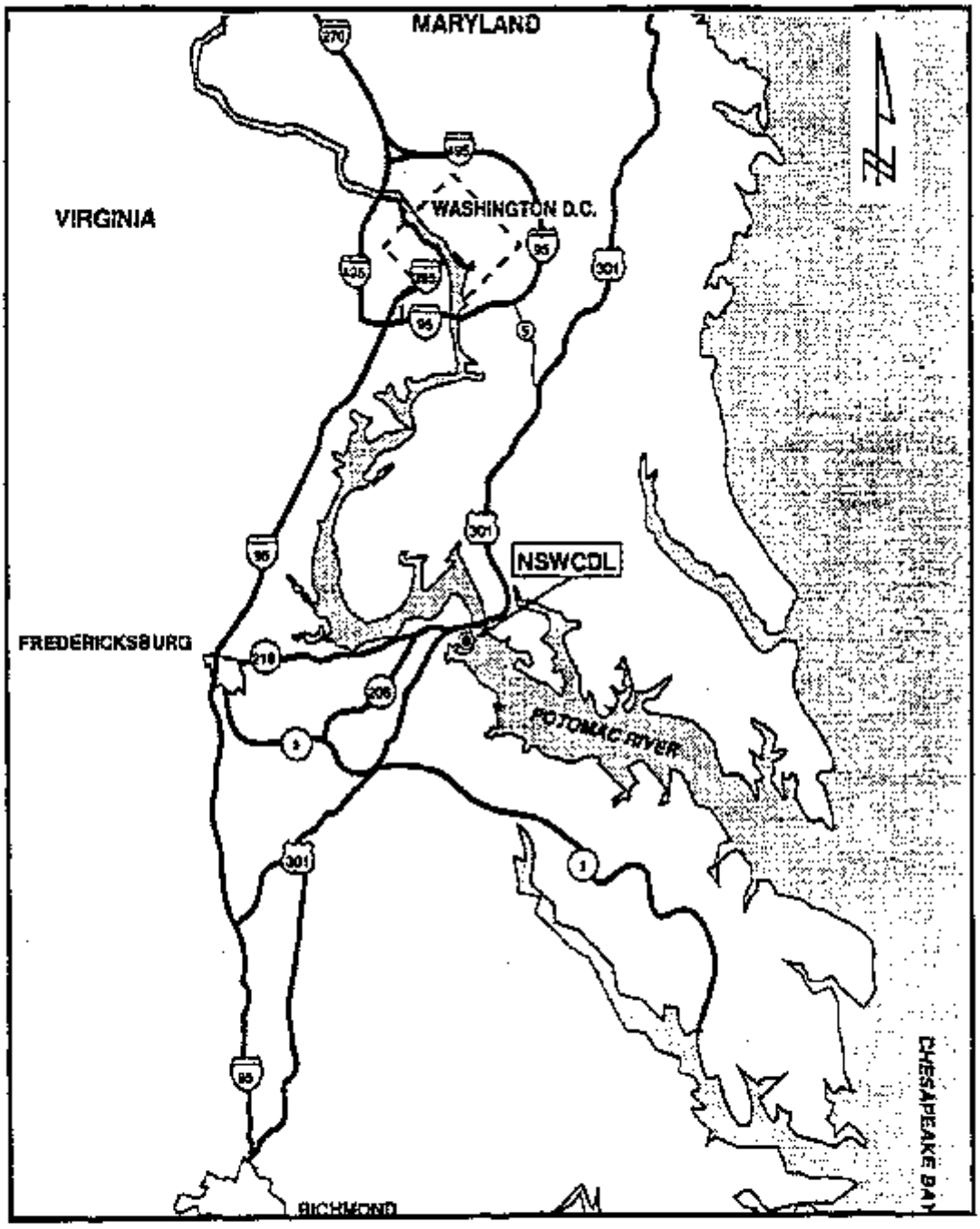
The Rocket Motor Pit (Site, 44) and the Ordnance Burn Structure (Site 3), collectively known as the No. 1 Powder Burn Area, are located in the north-central portion of the NSWCDL property near Gambo Creek and approximately 300 feet west of Bagby Road (Figure 2-3). Access to Site 3/44 is from Bagby Road, which forms the southern and eastern perimeter of the site. The site is bordered on the west by Gambo Creek and by Site 12, Chemical Burn Area, to the north. Site 2, Fenced Ordnance Burial Area, lies immediately south of Site 3/44 across Bagby Road.

Site 3/44 was operated as a Resource Conservation and Recovery Act (RCRA) open burning (OB) unit under interim status and had not received a RCRA Part B permit prior to ceasing operations in 1994. OB operations are considered thermal treatment of powders and waste rocket motors. A soil removal action was performed at Site 3/44 in 1998.

2.2 SITE 3/44 - HISTORY AND ENFORCEMENT ACTIVITIES

2.2.1 History of Site Activities

Operations at Site 3, Ordnance Burn Structure, consisted of burning explosives and explosive contaminated waste in burn pans, in a steel box, or on the ground through OB. The OB operations began in the 1960s and



Source: NAVFAC, 1993

DRAWN BY: TF	DATE: July 00	Tetra Tech NUS, Inc.	CONTRACT NO.: 7315-0551 / OWNER NO.: CTO 283
CHECKED BY: DM	DATE: July 00	NSWCDL LOCATION MAP	APPROVED BY / DATE
COST/SCHED-AREA			APPROVED BY / DATE
0 10 20 Scale in Miles		NSWCDL DAHLGREN, VIRGINIA	DRAWING NO.: Figure 2-1 / REV.: 0

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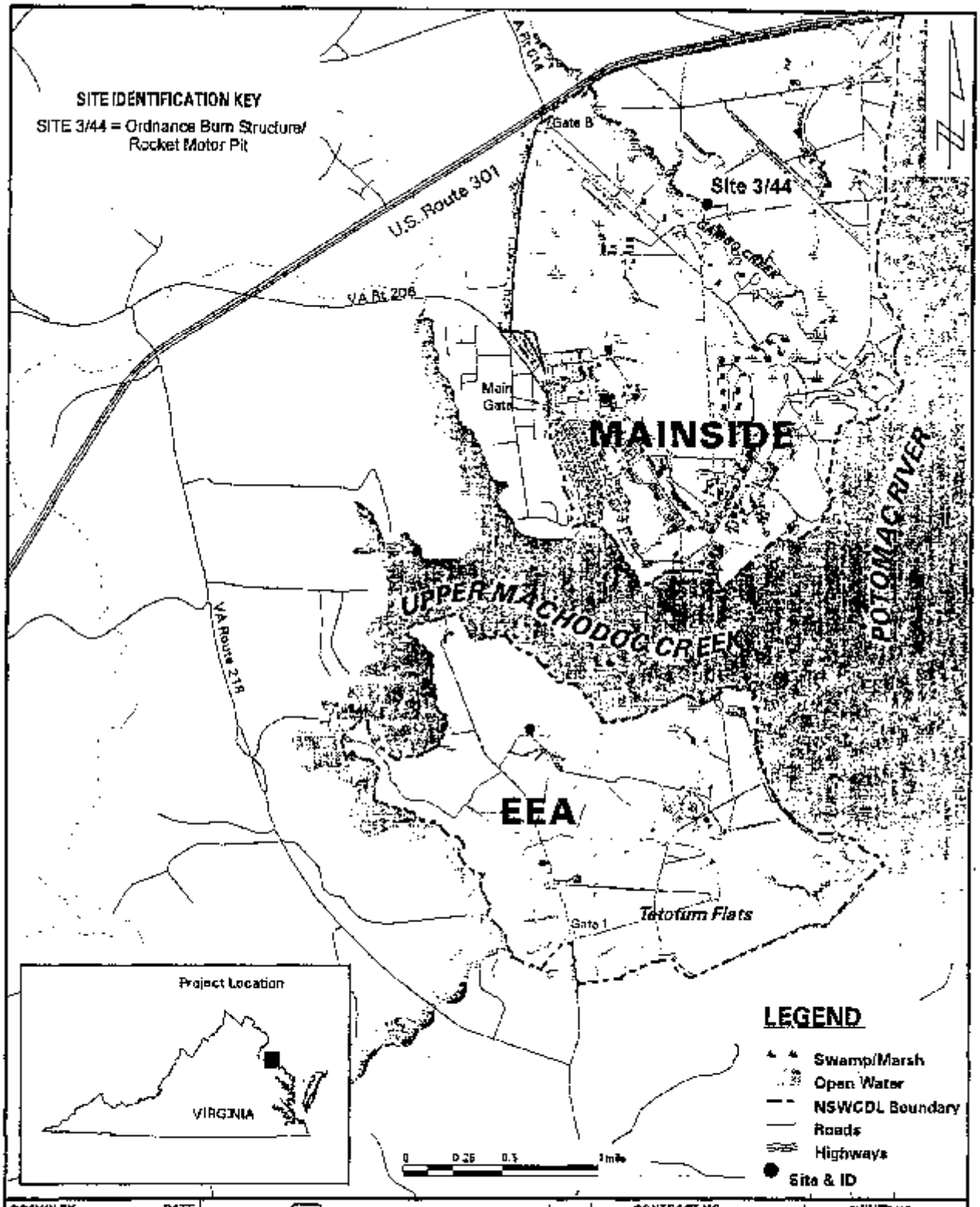

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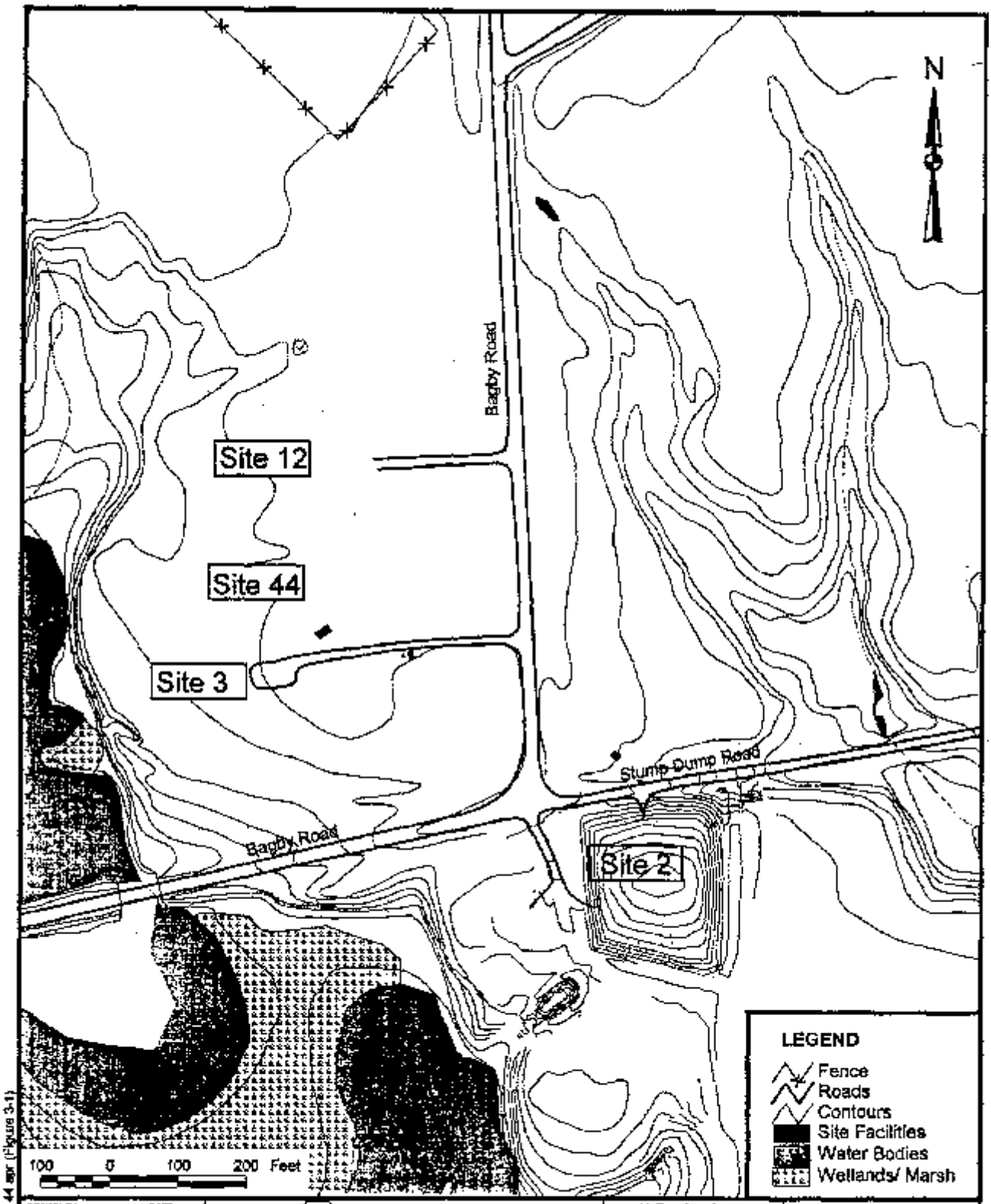

k:\gproject\whites 3 and 44 apr (Figure 3-1)

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COST/SCHEDULE AREA	SITE MAP	APPROVED BY DATE	
SCALE AS NOTED	NSWCDL DAHLGREN, VIRGINIA	DRAWING NO. Figure 2-3	REV 0

ceased in September 1994. Waste burned at Site 3 included wastewater treatment sludges from the processing of explosives (USEPA Waste Code K044), and spent carbon from the treatment of wastewater containing explosives (USEPA Waste Code K045). Site 3 also included a popping furnace structure located east of the burn area.

Site 44, Rocket Motor Pit, was in use from the early 1960s to 1994 to anchor waste rocket motors while they were burned. The only waste at Site 44 was that associated with solid rocket propellant or metal debris from the motor casings.

2.2.2 Previous Investigations and Response Actions

An initial soil screening, to identify preliminary contaminants of concern at Site 3/44, was completed in August 1996. Samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, pesticides, PCBs, explosives, and radiochemistry parameters. This sample data was used to focus the analytical list for the Pre-Design Investigation conducted in May 1997. Evaluation of the analytical results from the Pre-Design Investigation indicated limited organic and inorganic contamination. Based on the Pre-Design Investigation, an Engineering Evaluation/Cost Analysis (EE/CA) was developed and a soil removal was completed in October 1998. The EE/CA also provided the RCRA closure plan for soils at Site 3/44.

After the removal was completed, verification samples were collected. The chemicals detected in verification soil samples at Site 3/44 consisted of polynuclear aromatic hydrocarbons (PAHs), phthalates, and metals. Maximum concentrations of all PAHs and phthalates were less than their respective screening concentrations. Of the metals, arsenic was the only chemical detected at concentrations exceeding background and conservative, residential risk-based benchmarks.

In 1992, a closure plan for Site 3/44 was written to comply with the RCRA Part B permitting process. Part of the postclosure process outlined in Virginia Hazardous Waste Management Regulations (VHWMR) Section 10.6.I.1 and 40 CFR 264 and 265 requires groundwater monitoring. In 1996, a quarterly groundwater-monitoring program was initiated at Site 3/44.

Six monitoring wells have been installed at Site 3/44. Two wells were installed up gradient of the site and serve as background monitoring wells. The other four wells serve as Point of Compliance (POC) monitoring locations. The groundwater-monitoring program at Site 3/44 was complicated by the presence of a known upgradient source of contamination. Site 12 has been fully investigated under the Installation Restoration (IR) Program. At Site 12, VOCs (primarily, 1,1,1-tichloroethane and 1,1-Dichloroethene) and other constituents have been released to the water table aquifer and are currently migrating south to southwest toward the discharge location, Gambo Creek. Remediation at Site 12 is currently underway.

In 2000, a Remedial Investigation/Focused Feasibility Study (RI/FFS) was performed to assess residual risk following the removal action and groundwater monitoring. In addition, it provided the RCRA closure plan for groundwater at Site 3/44. The RI/FFS concluded no human health risks existed for soil and that groundwater contamination was not attributable to Site 3/44. As a result, the RI/FFS recommended that no further action be warranted for soil and groundwater at Site 3/44.

2.2.3 Enforcement Actions

No enforcement actions have been taken at Site 3/44. The Navy has owned this property since 1918 and is identified as the principal responsible party.

2.3 COMMUNITY PARTICIPATION

The Navy and NSWCDL have had a comprehensive public involvement program for several years. Starting in 1993, a Technical Review Committee (TRC) met, on average, twice a year to discuss issues related to investigative activities at NSWCDL. The TRC was composed of mostly governmental personnel; however, a few private citizens attended the meetings.

In the fall of 1994, the Navy converted the TRC into a Restoration Advisory Broad (RAB) and eight to ten community representatives joined. The RAB is co-chaired by a community member and has held meetings approximately every 4 to 6 months. The RI/FFS for Site 3/44 soils and groundwater were discussed at the RAB meetings.

In accordance with Section 113 and 117 of CERCLA, the Navy provided a Public Comment Period from July 20, 2000 through September 2, 2000 for the proposed remedial action, which is described in the RI/FFS and the Proposed Remedial Action Plan (PRAP) for Site 3/44.

The PRAP and RI/FFS were made available to the public in the Administrative Record and information repositories maintained at the Smoot Memorial Library, King George, Virginia; the NSWCDL General Library, Dahlgren, Virginia; and the NSWCDL Public Record Room, Dahlgren, Virginia. Public notice was provided in *The Freelance Star* newspaper on July 20, 2000 and a public meeting was held in the King George Courthouse on August 9, 2000.

Community relations activities for the final selected remedy included:

- The documents concerning the investigation and analysis at Site 3/44, as well as a copy of the Proposed Plan, were placed in the information repository at the NSWCDL General Library and the Smoot Memorial Library.

- A newspaper announcement on the availability of the documents and the public comment period/meeting date was placed in *The Freelance Star* newspaper on July 20, 2000.

- The Navy established a 45-day public comment period starting July 20, 2000 and ending September 2, 2000 for review of the Proposed Remedial Action Plan.

- A Public Meeting was held August 9, 2000 to answer any questions concerning the Site 3/44 Proposed Plan.

2.4 SCOPE AND ROLE OF RESPONSE ACTION AT SITE 3/44

NSWCDL is divided into two areas, (1) Mainside, consisting of 2,677 acres, and (2) the Explosive Experimental Area consisting of 1,614 acres. NSWCDL has 71 sites that require investigation and potential cleanup. These sites were prioritized based on potential risk to humans and the environment. Remedies have been started at ten of eleven top priority sites. Thirty-six of the remaining 60 sites require no further action based on risk. Investigations are ongoing or planned for the remaining sites. A list of all sites can be found in the current version of the Site Management Plan, which is located in the Administrative Record. The Site Management Plan contains location, description, contaminants of concern, and cleanup status of each site. Site 3/44 is included in the Site Management Plan.

A removal action was performed at Site 3/44 in 1998 to address metals contamination in the soils. In addition, groundwater monitoring was performed in 1996-1998 indicating that site-related contaminants did not warrant any additional action. This selected remedy, which follows the removal and groundwater monitoring, provides closure for the site.

The selected remedy (no further action for soils and groundwater) fits the Navy strategy to reduce risks at all NSWGDL sites with minimal long-term care. Site 3/44 soils are clean and require no future monitoring, allowing the Navy to focus its resources on the remaining NSWCDL sites. Groundwater sampling at Site 3/44 indicated the presence of VOCs and other constituents; however the pattern of contaminants detected in the shallow groundwater at Site 3/44 indicate the contaminants of concern are attributable to naturally occurring conditions or to the adjacent Site 12 and are not attributable to Site 3/44. The selected

remedy identified in this ROD addresses Site 3/44 as discussed in the Engineering Evaluation/Cost Analysis and the RI/FFS reports.

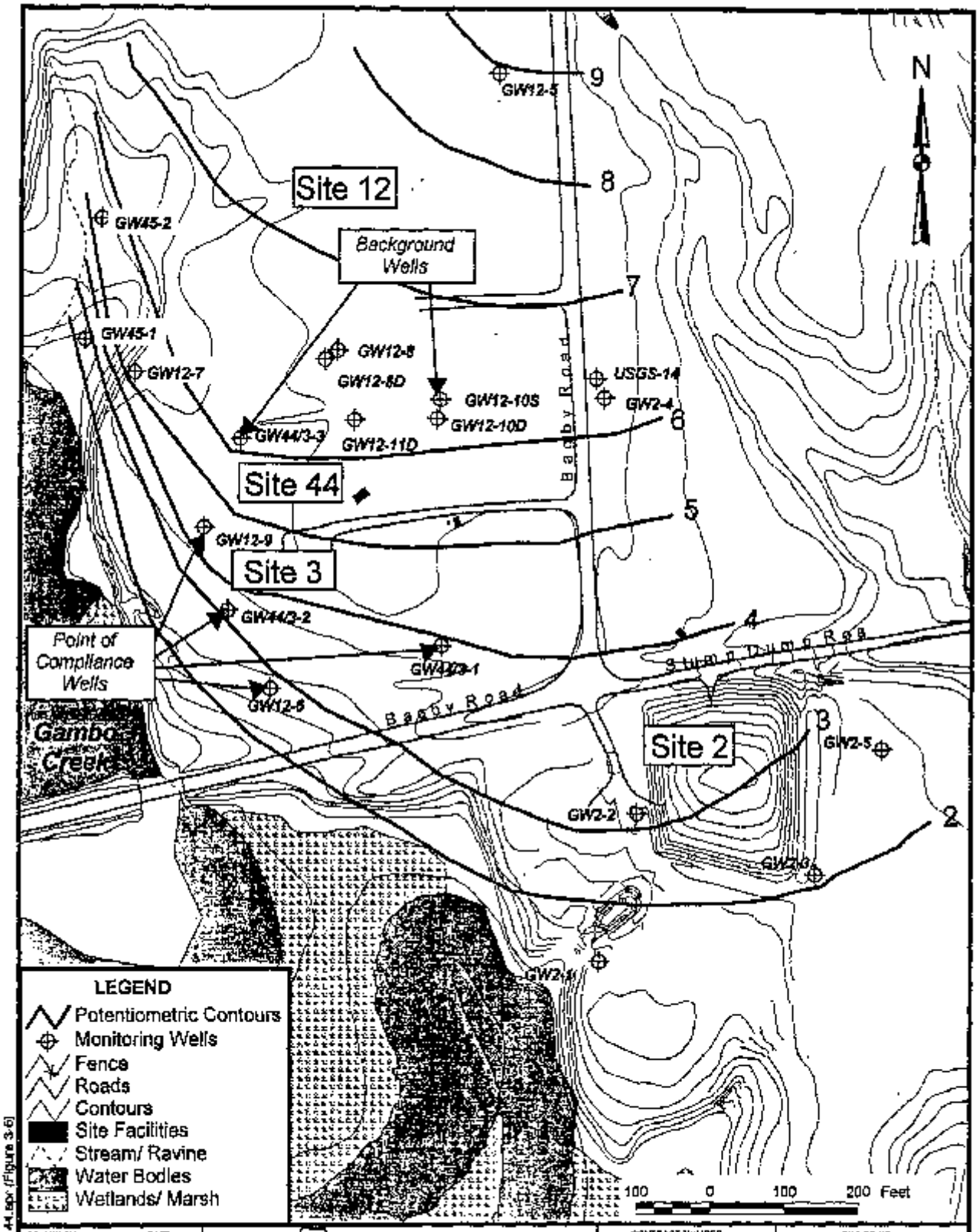
2.5 SUMMARY OF SITE 3/44 CHARACTERISTICS

Site 3/44, a ½-acre site located on the Mainside of NSWCDL, operated as an OB unit from the 1960s through 1994. The topographic relief of Site 3/44 is relatively low with a maximum elevation of approximately 15 feet mean sea level (msl). Gambo Creek is approximately 400 feet west of the site where a steep bank defines the Gambo Creek marsh area at an elevation of approximately 2 feet msl. The site is sparsely vegetated and grass covers the area where the 1998 soil removal occurred. Adjacent areas support scrub brush growth.

The Columbia aquifer is the uppermost aquifer at the NSWCDL. Regionally, the Tabb Formation is part of the Columbia aquifer, which is relatively thin (approximately 20 feet in the United States Geological Survey (USGS) study area). In the western portion of the Virginia coastal plain the Columbia aquifer is discontinuous. The Columbia is generally unconfined; however, clayey sediments within the formation may produce local confined or semi-confined conditions. In general, the groundwater in the shallow Columbia aquifer is assumed to discharge to Gambo Creek, the Potomac River, or other surface water bodies at the NSWCDL. The RI/FFS for Site 3/44 provides additional details on the aquifer and subsurface features.

The watertable (or Columbia) aquifer beneath Site 3/44 is a thin water-bearing zone underlain by a laterally persistent clay confining layer (or Upper Confining Unit) approximately 30 feet thick at Site 3/44. Shallow groundwater at NSWCDL is known to discharge to adjacent shallow water bodies, in this case Gambo Creek. According to the USGS study of basewide groundwater quality, the watertable aquifer at NSWCDL is generally of poor quality because of high, naturally occurring concentrations of some metals (i.e., iron and manganese).

Surface water in the vicinity of Site 3/44 either infiltrates due to the flat topography and lack of vegetation, or flows overland toward Gambo Creek. A drainage ditch exists east of Site 3/44 and parallels Bagby Road. A swale west of Site 3/44 directs drainage to Gambo Creek. Figure 2-4 presents a representative groundwater elevation (potentiometric) map of Site 3/44.


N
Site 12
Background Wells
Site 44
Site 3
Site 2
Point of Compliance Wells
Gambo Creek
Bagby Road
Sumo Dump Rd
GW12-5
GW45-2
GW45-1
GW12-7
GW12-8
GW12-8D
GW12-10S
GW12-10D
GW12-11D
GW44/3-3
USGS-14
GW2-4
GW12-9
GW44/2-2
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Contours
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COST/SCHEDULE-AREA
SCALE AS NOTED
Tetra Tech NUS, Inc.
POTENTIOMETRIC SURFACE MAP
(10/14/97)
SITE 3/44
NSWCDL, DAHLGREN, VIRGINIA
CONTRACT NUMBER 7316-0551
OWNER NO. CTO 263
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Groundwater monitoring was conducted at Site 3/44 between 1996 and 1998. Three explosives were detected in the groundwater at Site 3/44 (RDX; 2-amino-4,6-dinitrotoluene; and 4-amino-2,6-dinitrotoluene). The source of the explosive compounds at site 3/44 was the thermal treatment of powders and waste rocket motors during OB operations. These explosive compounds are known to migrate through the soil into the groundwater.

Based on past use of the site, an initial soil screening was performed to identify the contaminants of concern at Site 3/44. Following the soil screening, results of a Pre-Design Investigation indicated limited organic and inorganic contamination. Those that exceeded USEPA Region lll Risk-Based Concentrations (RBCs) are presented below:

- Analytical results indicated that arsenic exceeded the USEPA Region III industrial Risk-Based Concentration (RBC).

- Contaminants that exceeded USEPA Region III residential RBCs included arsenic, iron, aluminum, nickel, manganese, chromium, and vanadium. Of these contaminants, nickel, manganese, and vanadium had only one detected exceedance of the residential RBC.

Based on the results of the Pre-Design Investigation and EE/CA, a removal action was performed at the site. The removal action included excavation and off-site disposal of:

- The gravel in the area of Site 3.

- An additional 18 inches of soil directly b beneath the gravel.

- Eighteen inches of soil from the bottom of the rocket motor pit (Site 44).

- The top six inches of surface soil in the vicinity of Site 3/44 as a “house-keeping measure” to remove any potential contaminants of concern. This area was selected such that all sample locations at which arsenic exceeded the industrial RBC screening levels fell within the boundary.

- The earthen mounds adjacent to the rocket motor pit.

After the soil removal was completed in 1998, verification soil samples were collected and evaluated followed by backfilling the area with clean soil. Based on the statistical analysis of the composite verification sample results and the qualitative assessment of the discrete sample results, the soils at Site 3/44 were "clean-

closed" under RCRA. "Clean-closed" soils are considered acceptable for any future land use including residential development, based upon human health risks.

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Site 3/44, located in the north-central portion of the NSWCDL Mainside, currently is an industrial use area and is anticipated to remain an industrial use area in the future. The mission of the base is currently expanding and future potential for base closure and conversion to residential land use is considered to be minimal. Groundwater in the shallow aquifer beneath Site 3/44 is not a current source of drinking water.

The watertable (or Columbia) aquifer beneath Site 3/44 is a thin water-bearing zone underlain by a laterally persistent clay confining layer (or Upper Confining Unit). Shallow groundwater at NSWCDL is known to discharge to adjacent shallow water bodies, in this case Gambo Creek. According to a United States Geological Survey (USGS) study of basewide groundwater quality, the watertable aquifer at NSWCDL is generally of poor quality because of high, naturally occurring concentrations of some metals (i.e., iron and manganese). Poor water quality, coupled with the thin saturated thickness and locally high percentages of fine grain sediments, effectively diminishes the feasibility of using the watertable aquifer as an industrial or potable water source. However, during the risk evaluation for Site 3/44, the watertable aquifer is considered to be a potential source of potable water.

2.7 SUMMARY OF SITE 3/44 RISKS

The ecological and human health risks associated with exposure to contaminated media at Site 3/44 were evaluated in the RI/FFS Report.

2.7.1 Human Health Risks

The baseline risk assessment estimates what risks the site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for this site. The human health risk assessment is presented in Section 3.6 of the Site 3/44 RI/FFS.

Identification of Chemicals of Potential Concern

Table 2-1 presents the chemicals of potential concern (COPCs) and exposure point concentration (EPC) for each of the COPCs detected in groundwater (i.e., the concentration that will be used to estimate the

TABLE 2-1

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY - GROUNDWATER
SITE 3/44 - ORDNANCE BURN STRUCTURE/ROCKET MOTOR PIT
NSWCDL, DAHLGREN, VIRGINIA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Groundwater

Chemical of Potential Concern	Units	Minimum Detected Concentration	Maximum Detected Concentration	EPC Units	EPC Value	Frequency of Detection	Statistical Measure
Arsenic (unfiltered)	mg/L	2.7E-03	1.10E-02	mg/L	1.10E-02	8/19	Maximum
2-Amino-4,6-dinitrotoluene	mg/L	8.5E-05	3.60E-04	mg/L	3.60E-04	2/5	Maximum
RDX	mg/L	4.0E-04	4.80E-04	mg/L	4.80E-03	12/19	Maximum
1,1,1-Trichloroethane	mg/L	2.0E-02	5.00E-01	mg/L	5.00E-01	14/19	Maximum
1,1-Dichloroethene	mg/L	3.0E-02	5.20E-02	mg/L	5.20E-02	14/19	Maximum

EPC. - Exposure Point Concentration

exposure and risk from each COPC in the groundwater). The table includes the range of concentrations detected for each COPC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. Due to the limited amount of sample data available for each COPC, the maximum concentration was used as the default exposure point concentration.

A risk analysis of potential exposure to post-removal soil was performed and reported in the statistical analysis report for Site 3/44. This report evaluated VOCs, SVOCs, explosives, and metals by comparing them to USEPA Region III Risk Based Characteristics (RBCs) for residential land use and USEPA Generic Soil Screening Levels (SSLs) for migration to groundwater. Metals were also compared to site-specific background levels by statistical tests. The results of the verification sample analysis indicated that the concentrations of all organic constituents were less the Region III and USEPA criteria. Concentrations of metals were either less than criteria or were within naturally occurring background levels. Therefore, no constituents were selected as COPCs in soil at Site 3/44 and potential risks from exposure to soil were not evaluated further in the risk assessment conducted for the Site 3/44 RI/FFS.

Exposure Assessment

Several potential receptor populations were initially considered for inclusion in the exposure assessment. However, the majority of these receptors were eliminated from further evaluation based on site conditions, likelihood of exposure, etc. Of the receptors initially considered for exposure to groundwater (base workers, recreational users, on- and off-base residents, trespassers, and construction workers), only the hypothetical future resident and construction worker have been retained for quantitative evaluation in this risk assessment. Table 2-2 summarizes the current and future scenarios considered for Site 3/44. Although no potable use of the water table aquifer occurs or is likely to occur in the vicinity of the base, the risk assessment evaluated potential risks to future onsite residents from exposure to COPCs in groundwater. Potential risks to future excavation/construction workers were evaluated in the risk assessment because it is possible that an excavation (for construction, utility maintenance, etc.) could be deep enough to come into contact with shallow groundwater at Site 3/44. In such an instance, workers could be exposed to groundwater via dermal contact. Assuming potential, future site conditions and land use, the exposure routes evaluated included ingestion of groundwater, dermal contact with groundwater, and inhalation of volatiles emitted from groundwater while showering.

TABLE 2-2

SUMMARY OF EXPOSURE SCENARIOS
SITE 3/44 ! ORDNANCE BURN STRUCTURE/ROCKET MOTOR PIT
NSWCDL, DAHLGREN, VIRGINIA

Medium	Receptor	Exposure Route
FUTURE SCENARIO		
Groundwater	Hypothetical Future Residents (Adult and Child)	Ingestion Dermal Absorption Inhalation of Volatiles while Showering
Groundwater	Excavation/Construction Workers	Dermal Absorption

Toxicity Assessment

The toxicity assessment characterizes the nature and magnitude of potential health effects associated with human exposure to COPCs at each site. Quantitative risk estimates for each COPC and exposure pathway are developed by integrating chemical-specific toxicity factors with estimated chemical intakes discussed in the previous section.

Quantitative risk estimates are calculated using cancer slope factors (CSFs) for COPCs exhibiting carcinogenic effects and reference doses (RfDs) for COPCs exhibiting systemic (noncarcinogenic) effects. A summary of the RfDs and CSFs used in the baseline human health risk assessment presented in the Site 3/44 RI/FFS are presented in Tables 2-3, 2-4, 2-5, and 2-6.

CSFs have been developed by USEPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CSFs are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term “upper bound” reflects the conservative estimate of the risks calculated from the CSFs. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer slope factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

RfDs have been developed by the USEPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared with the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

CSFs and RfDs are based on ingestion (oral) or inhalation routes of exposure rather than dermal contact. Therefore, these values reflect administered doses rather than absorbed doses. USEPA guidance on assessment of dermal exposure recommends that oral toxicity factors used in dermal risk assessment be adjusted for gastrointestinal absorption efficiency, if such data are available. The dermal RfDs and CSFs adjusted for gastrointestinal absorption are listed in Tables 2-3 and 2-5. The dermal toxicity criteria are derived per the methodology presented in Appendix A of the Risk Assessment Guidance for Superfund, Part A.

TABLE 2-3

CANCER TOXICITY DATA -- ORAL/DERMAL
SITE 3/44 - ORDNANCE BURN STRUCTURE/ROCKET MOTOR PIT
NSWCDL, DAHLGREN, VIRGINIA

Chemical of Potential Concern	Oral CSF	Oral to Dermal Adjustment Factor[1]	Adjusted Dermal Cancer Slope Factor[2]	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date[3]
Arsenic	1.5E+00	0.95	1.58E+00	$(mg/kg\text{-}day)^{-1}$	A-inhalation	IRIS	4/13/00
RDX	1.1E-01	1	1.10E-01	$(mg/kg\text{-}day)^{-1}$	C	IRIS	4/13/00
1,1-Dichloroethene	6.0E-01	1	6.00E-01	$(mg/kg\text{-}day)^{-1}$	C	IRIS	4/13/00

1 USEPA's Risk Assessment Guidance for Superfund, Volume 1.
2 CSF dermal = CSF oral/(Oral to Dermal Adjustment Factor)
3 Dates of IRIS

Notes:
CSF = Cancer Slope Factor
IRIS = Integrated Risk Information System, on-line database search

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

TABLE 2-4

CANCER TOXICITY DATA -- INHALATION
SITE 3/44 - ORDNANCE BURN STRUCTURE/ROCKET MOTOR PIT
NSWCDL, DAHLGREN, VIRGINIA

Chemical of Potential Concern	Unit Risk	Units	Adjustment	Inhalation Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date
1,1 - Dichloroethene	5.0E-05	$(mg/m^3)^{-1}$	3.5E+03	1.75E-01	$(mg/kg\text{-}day)^{-1}$	C	IRIS	4/13/00

IRIS = Integrated Risk Information System

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

TABLE 2-5

NONCANCER TOXICITY DATA -- ORAL/DERMAL
SITE 3/44 - ORDNANCE BURN STRUCTURE/ROCKET MOTOR PIT
NSWCDL, DAHLGREN, ViRGINIA

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD	Oral RfD Units	Oral to Dermal Adjustment Factor[1]	Adjusted Dermal RfD[2]	Dermal RfD Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sourcea of RfD: Target Organ	Dates of RfD: Target Organ[3]
2-Amino-4,6-dinitrotoluene	chronic	6.0E-05	mg/kg-day	1	6.00E-05	mg/kg-day			IRIS	04/13/00
Arsenic	chronic	3.0E-04	mg/kg-day	0.95	2.85E-04	mg/kg-day	Skin	3	IRIS	04/13/00
RDX	chronic	3.0E-03	mg/kg-day	1	3.00E-03	mg/kg-day	Prostate	100	IRIS	04/13/00
1,1-Dichloroethene	chronic	9.0E-03	mg/kg-day	1	9.00E-03	mg/kg-day	Liver	1,000	IRIS	04/13/00
1,1,-Trichloroethane	chronic	2.0E-02	mg/kg-day	1	2.00E-02	mg/kg-day			NCEA	04/13/00

1 USEPA's risk Assessment Guidance for Superfund, Volume 1.
2 RfD dermal = RfD oral x (Oral to Dermal Adjustment Factor)
3 Dates of IRIS or NCEA

Notes: RfD = Reference dose
IRIS = Integrated Risk Information System, on-line database search
NCEA = USEPA National Center for Environmental Assessment

TABLE 2-6

NONCANCER TOXICITY DATA – INHALATION
SITE 3/44 - ORDNANCE BURN STRUCTURE/ ROCKET MOTOR PIT
NSWCDL, DAHLGREN, VRGINIA

Chemical or Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Unit	Adjusted Inhalation RfD (1)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Date
1,1,1-Trichloroethane	Chronic	1.0E+03	mg/m^3	2.86E-01	mg/kg-day	None	None	NCEA	4/13/00

N/A = Not Applicable
1 Provide equation used for derivation in text.
For NCEA values, provide the date of the article provided by NCEA.

Risk Characterization

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

Risk = CDI x SF

Where:

Risk = a unitless probability (e.g., 2 x 10^{-5}) an individual's developing cancer

CDI = chronic daily intake averaged over 70 years (mg/kg-day)

SF = slope factor, expressed as $(mg/kg\text{-}day)^{-1}$

These risks are probabilities that usually are expressed in scientific notation (e.g, 1 x 10^{-6}). An excess lifetime cancer risk of $1x10^{-6}$ indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individual's face from other causes such as smoking or exposure to too much sun. The chance of an Individual's developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposures is 10^{-4} to 10^{-6} .

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., life time) with a RfD derived for a similar exposure period. An RfD represents a level that an individual may be exposure to that is not expected to cause any deleterious effects. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ<1 indicates that a receptors dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI>1 indicates that site-related exposure may present a risk to human health.

The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

where:

CDI = Chronic daily intake
RfD = Reference dose.

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

Excavation/Construction Worker. The cumulative ingestion, dermal, and inhalation cancer risk (Table 2-7) is 4.1×10^{-6}, which is within the USEPA's target risk range of 1×10^{-4} to 1×10^{-6}. The cumulative noncancer Hazard Index (HI) is 0.34 for the excavation/construction worker from exposure to groundwater by dermal contact. If the HI is greater than unity (1) then noncarcinogenic health effects may be possible.

As a result, these calculated risks indicate no adverse health affects are expected for excavation/construction workers under the conditions defined in the risk assessment.

Future Residents. The noncarcinogenic risk results (Tables 2-8 and 2-9) indicate that HIs for the reasonable maximum exposure (RME) case for residents exposed to COPCs in groundwater are 2.2 and 5.1 for adults and children, respectively. These elevated HIs are primarily attributable to the ingestion of arsenic (adult HI = 1.0, child HI = 2.3) and 1,1,1-trichloroethane (adult HI = 0.8, child HI = 1.9) in groundwater. 1,1-Dichloroethene and 1,1,1-trichloroethane were selected as COPCs in groundwater at Site 3/44 even though these compounds are attributable to Site 12. The source of the 1,1-Dichloroethene and 1,1,1-trichloroethane contamination at Site 12 is currently being remediated. Arsenic concentrations in the groundwater most likely reflect upgradient or background conditions. The elimination of arsenic, 1,1-Dichloroethene, and 1,1,1-thrichloroethane as COPCs results in cumulative HIs for the hypothetical child resident and adult resident of 0.23 and 0.52, respectively. An HI less than unity (1) indicates that adverse noncarcinogenic health effects are not anticipated under the conditions established in the exposure assessment.

The carcinogenic risk for the future adult resident is 5.2×10^{-4} exposed to groundwater (Table 2-8). The carcinogenic risk for the future child resident is 3.2×10^{-4} exposed to groundwater (Table 2-9). The estimated total lifetime carcinogenic risk for the future hypothetical resident (child + adult) exposed to groundwater (i.e., using the groundwater as a domestic source) is 8.4×10^{-4} for the RME. This risk estimate

TABLE 2-7

REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CONSTRUCTION WORKER
SITE 3/44 - ORDNANCE BURN STRUCTURE / ROCKET MOTOR PIT
NSWCDL, DAHLGREN, VIRGINIA

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

				Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
Medium	Exposure Medium	Exposure Point	Chemical	Ingestion	Inhalation	Dermal	Exposure Routes Total	Chemical	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Water	Onsite	Arsenic			1.3E-07	1.3E-07	Arsenic	Skin			2.0E-02	2.0E-02
			2-Amino-4,6-dinitrotoluene					2-Amino-4,6-dinitrotoluene	None			9.7E-03	9.7E-03
			RDX			1.1E-07	1.1E-07	RDX	Prostate			2.3E-02	2.3E-02
			1,1,1-Trichloroethane					1,1,1-Trichloroethane	None			2.4E-01	2.4E-01
			1,1-Dichloroethene			3.9E-06	3.9E-06	1,1-Dichloroethene	Liver			5.0E-2	5.0E-02
						Total Risk Across Groundwater	4.1E-06		Total Hazard Index Across All Media and All Exposure Routes				3.4E-01

Total Risk Across All media and All Exposure Routes	4.1E-06

Total Skin HI =	2.0E-02
Total Prostate HI =	2.3E-02
Total Liver HI =	5.0E-02

TABLE 2-8

REASONABLE MAXIMUM EXPOSURE (RME)

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs -FUTURE ADULT RESIDENT

SITE 3/44 - ORDNANCE BURN STRUCTURE / ROCKET MOTOR PIT

NSWCDL, DAHLGREN, VIRGINIA

Scenario Timeframe: Future
Receptor Population: Resident
Adult

				Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
Medium	Exposure Medium	Exposure Point	Chemical	Ingestion	Inhalation	Dermal	Exposure Routes Total	Chemical	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Water	Onsite	Arsenic	1.5E-04		3.7E-07	1.6E-04	Arsenic	Skin	1.0E+00		2.4E-03	1.0E+00
			2-Amino-4,6-dinitrotoluene					2-Amino-4,6-dinitrotoluene	None	1.6E-01		5.4E-03	1.7E-01
			RDX	5.0E-06		1.6E-06	6.6E-06	RDX	Prostate	4.4E-02		1.5E-02	5.8E-02
			1,1,1-Trichloroethane					1,1,1-Trichloroethane	None	6.8E-01	1.4E-02	1.1E-01	8.1E-01
			1,1-Dichloroethene	2.9E-04	2.8E-05	3.4E-06	3.6E-04	1,1-Dichloroethene	Liver	1.6E-01		1.8E-02	1.8E-01
							Total Risk AcrossGroundwater	5.2E-04					Total Hazard Index Across All Media and All Exposure Routes	2.2E+00

Total Risk Across All media and All Exposure Routes	5.2E-04

Total Skin HI =	1.0E+00
Total Prostate HI =	5.8E-02
Total Liver HI =	1.8E-01

TABLE 2-9

REASONABLE MAXIMUM EXPOSURE (RME)

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - FUTURE ADULT RESIDENT

SITE 3/44 - ORDNANCE BURN STRUCTURE / ROCKET MOTOR PIT

NSWCDL, DAHLGREN, VIRGINIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: child (0 - 6 years)

				Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
Medium	Exposure Medium	Exposure Point	Chemical	Ingestion	Inhalation	Dermal	Exposure Routes Total	Chemical	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Water	Onsite	Arsenic	9.0E-05		1.5E-07	9.1E-05	Arsenic	Skin	2.3E+00		4.0E-03	2.3E+00
			2-Amino-4,6-dinitrotoluene					2-Amino-4,6-dinitrotoluene	None	3.8E-01		9.0E-03	3.9E-01
			RDX	2.9E-06		6.9E-07	3.6E-06	RDX	Prostate	1.0E-01		2.5E-02	1.3E-01
			1,1,1-Trichloroethane					1,1,1-Trichloroethane	None	1.6E+00	8.4E-02	1.8E-01	1.9E+00
			1,1-Dichloroethene	1.7E-04	4.2E-05	1.4E-05	2.3E-04	1,1-Dichloroethene	Liver	3.7E-01		3.1E-02	4.0E-01
							Total Risk Across Groundwater	3.2E-04					Total Hazard Index Across All Media and All Exposure Routes	5.1E+00

Total Risk Across All media and All Exposure Routes: 3.2E-04

Total Skin HI = 2.3E+00
Total Prostate HI = 1.3E-01
Total Liver HI = 4.0E-01

exceeds the target risk range of 1.0×10^{-6} to 1.0×10^{-4} . However, an examination of the chemical-specific risks discussed in the RI/FFS indicates that this cancer risk is a result of the ingestion of arsenic and 1,1-DCE in groundwater. As discussed in the RI/FFS, 1,1-DCE was selected as a COPC in groundwater at Site 3/44, even though it is attributable to Site 12, which is being remediated. The maximum detected arsenic concentration (11 µg/L) evaluated as the exposure point concentration was less than the concentrations reported for the upgradient wells at Site 3/44 and less than the current Safe Drinking Water Act (SDWA) maximum contaminant level (MCL) (50 Fg/L). Consequently, although arsenic was retained as a groundwater COPC for Site 3/44, it is very likely that the maximum site concentration reflects background or upgradient conditions. If arsenic and 1,1-DCE are not included as COPCs, the total residential cancer risk would be 1.0×10^{-5} (primarily from RDX), which is within the USEPA's target risk range.

Uncertainty Analysis. The major sources of uncertainty specific to post-removal conditions at Site 3/44 include:

- The maximum reported concentrations were used as the exposure point concentrations either because the distribution of the data was undefined or because the data set evaluated contained less than 10 samples. The total risk estimates may be overestimated as a result of the evaluation of maximum concentrations for all COPCs.

- The arsenic concentrations in groundwater may reflect background (or upgradient) conditions (i.e., upgradient and downgradient concentrations are similar). Also, 1,1-Dichloroethene and 1,1,1-trichloroethane were selected as COPCs in groundwater at Site 3/44 although these compounds were also detected in upgradient wells and are being remediated at the source (Site 12). If arsenic, 1,11-Dichloroethene and 1,1,1-trichloroethane were eliminated as COPCs for groundwater, the total residual carcinogenic risk estimate for the hypothetical future resident exposed to groundwater would fall within the USEPA target risk range and the HIs would be less than the goal of unity (1).

2.7.2 Ecological Risks

Site 3/44 is adjacent to Site 12. An ecological risk assessment for Site 12, prepared for all media, determined that remedial action was required to address potential future ecological risks related to the transport of: 1) 1,1,1-trichloroethane in subsurface soil to groundwater to sediments in Gambo Creek; and 2) 1,1-Dichloroethene and 1,1,1- trichloroethane in groundwater to sediments in Gambo Creek. The ongoing remedial action at Site 12 is designed to address these potential future ecological risks.

Areas of Gambo Creek that are adjacent to Site 3/44 and Site 12 are currently being investigated as part of the Gambo Creek Ecological Assessment or as individual sites identified in the Site Management Plan. These investigations are designed to evaluate ecological risks that may result from all sites adjacent to Gambo Creek within NSWCDL.

Site 3/44 surface and subsurface soils that were impacted by related site operations were removed in 1998. Clean soil was used to backfill the areas that had been excavated.

In addition to the ongoing Site 12 remedial action, and the ongoing Gambo, Creek Ecological Assessment, a screening ecological risk assessment was prepared for current (past soil removal) conditions at Site 3/44.

2.7.3 Ecological Risk Characterization

For the screening level ecological risk assessment, two sets of soil data were screened using EPA Region 3 Biological Technical Assistance Group (BTAG) surface soil values for detected chemicals. These data are summarized in Tables 2-10 and 2-11.

The first set of data included surface soil samples that were taken prior to the soil removal action. A total of 13 soil samples were taken from outside the removal area. The maximum detected concentration for these 13 soil samples are presented in Table 2-10. Thirteen PCOCs were identified after comparing maximum concentrations to the screening values.

The second set of data included surface and subsurface soil samples that were taken after the soil removal action. The removal area covered approximately 0.54 acres which was split into two 0.27 acre exposure areas. A total of six composite soil samples were collected from each exposure area. The samples were a composite of grab samples taken at a depth of zero to 24 inches from the surface. The maximum detected concentration for these 16 soil samples are presented in Table 2-11. Twelve PCOCs were identified after comparing maximum concentrations to the screening values.

2.7.4 Ecological Risk Management

The Potential Contaminants of Concern (PCOCs) were evaluated during a risk management step to better assess the level of potential uncertainty in risk to ecological receptors from soils remaining at Site 3/44. This additional management step was taken because it is difficult to justify additional costs for remediation

TABLE 2-10

SCREENING ECOLOGICAL RISK ASSESSMENT SUMMARY
POTENTIAL CONTAMINANTS OF CONCERN (PCOCS) FOR PREDESIGN SAMPLES
NSWCDL, DAHLGREN, VIRGINIA

Chemical	EPA Region 3 Screening Level Surface Soil (mg/kg)	Pre-Design Samples Maximum Hit (mg/kg)	NOTES	PCOC
Volatile Organic Compounds				
1,1,1-Trichloroethane	0.3			N
2-Butanone	NA			N
Acetone	NA			N
Carbon Disulfide	NA			N
Toluene	0.1			N
Semivolatile Organic Compounds				
Acenaphthene	0.1			N
Anthracene	0.1			N
Benzo(a)anthracene	0.1			N
Benzo(a)pyrene	0.1			N
Benzo(b)fluoranthene	0.1			N
Benzo(g,h,i)perylene	0.1			N
Benzo(k)fluoranthene	0.1			N
Bis(2-Ethylhexyl)phthalate	NA			N
Carbazole	NA			N
Chrysene	0.1			N
Dibenzo(a,h)anthracene	0.1			N
Fluoranthene	0.1			N
Fluorene	0.1			N
Indeno(1,2,3-cd)pyrene	0.1			N
Phenanthrene	0.1			N
Pyrene	0.1			N
Pesticides and PCBs				
4,4'-DDD	0.1			N
4,4'-DDE	0.1			N
Metals and Inorganic Compounds				
Aluminum	1	15,400		Y
Antimony	0.48	0.73		Y
Arsenic	328	3.6		N
Barium	440	37.7		N
Beryllium	0.02	0.37		Y
Cadmium	2.5	0.34		N
Calcium	NA	676	nutrient	N
Chromium	0.0075	19.0		Y
Cobalt	100	3.7		N
Copper	15	9.4		N
Cyanide	0.005	0.48		Y
Iron	12	31700		Y
Lead	0.01	24.3		Y
Magnesium	4400	864		N
Manganese	330	69.2		N
Mercury	0.058	0.12		Y
Nickel	2	6.7		Y
Potassium	NA	931	nutrient	N
Selenium	1.8	2.5		Y
Silver	0.0000098	0.36		Y
Sodium	NA	39.9	nutrient	N
Thallium	0.001	NA		N
Vanadium	0.5	31.4		Y
Zinc	10	31.2		Y

NA - None Available

Blank Cell - Constituent either not analyzed or reported as a nondetected value.

TABLE 2-11

SCREENING ECOLOGICAL RISK ASSESSMENT SUMMARY
POTENTIAL CONTAMINANTS OF CONCERN (PCOCS) FOR VERIFICATION SOIL SAMPLES
NSWCDL, DAHLGREN, VIRGINIA

Chemical	EPA Region 3 Screening Level Suface Soil (mg/kg)	Verfication Soil Samples Maximum (mg/kg)	NOTES	PCOC
Volatile Organic Compounds				
1,1,1-Trichlorcethane	0.3			N
2-Butanone	NA			N
Acetone	NA			N
Carbon Disuffide	NA			N
Toluene	0.1			N
Semivolatile Organic Compounds				
Acenaphthens	0.1			N
Anthracene	0.1			N
Benzo(a)anthracene	0.1	0.051		N
Benzo(a)pyrene	0.1	0.041		N
Benzo(b)fluoranthene	0.1	0.079		N
Benzo(g,h,I)perylene	0.1	0.041		N
Benzo(k)fluoranthene	0.1			N
Bis(2-Ethylhexyl)phthalate	NA			N
Carbazole	NA			N
Chrysene	0.1	0.056		N
Dibenzo(a,h)anthracene	0.1			N
Fluoranthene	0.1	0.068		N
Fluorene	0.1			N
Indeno(1,2,3-od)pyrens	0.1			N
Phenanthrene	0.1	0.13		Y
Pyrene	0.1	0.16		Y
Pesticides and PCBs				
4,4'-DDD	0.1			N
4,4'-DDE	0.1			N
Metals and Inorganic Compounds				
Aluminum	1	5,490		Y
Antimony	0.48	NA		N
Arsenic	328	2.8		N
Barium	440	18.7		N
Beryllium	0.02	0.16		Y
Cadmium	2.5	14		Y
Calcium	NA	1,150	nutrient	N
Chromium	0.0075	8		Y
Cobalt	100	1.1		N
Copper	15	21.5		Y
Cyanide	0.005	NA		N
Iron	12	6,740		Y
Lead	0.01	8.7		Y
Magnesium	4400	405		N
Manganese	330	31.6		N
Mercury	0.058	0.03		N
Nickel	2	4.2		Y
Potassium	NA	354	nutrient	N
Selenium	1.8	NA		N
Silver	0.0000098	NA		N
Sodium	NA	65	nutrient	N
Thallium	0.001	NA		N
Vanadium	0.5	12.3		Y
Zinc	10	16.4		Y

NA - None Available

Blank Cell - Constituent either not analyzed or reported as a nondetected value.

for specific chemicals that do not accumulate in plants and animals, or have mean concentration across the site that are below screening criteria or that are within or below the range of background concentrations. NSWCDL Mainside surface soil background values were used for all comparisons.

Other factors were also considered to decide if an unacceptable risk remained at Site 3/44 and additional remediation would be warranted. The post soil removal verification sampling program was developed in accordance with the USEPA's Soil Guidance User's Guide, as described in the 1999 Statistical Analysis Report of Verification Sampling Analysis Results. The program provides for dealing with situations where there is some gray region (due to uncertainty that the sampling and analysis is representative and accurate) when comparing the screening concentration to the concentration detected in the composite samples. In such situations, the composite soil sample concentration must exceed 2 times the screening concentration for there to be confidence that the screening concentration was exceeded and further action may be warranted.

Because most of the contaminants were compounds that do not accumulate in plants and animals, or up the food chain, and because of the small site size, risks to the receptors are expected to be minimal.

Additional factors also included: alternative screening values and the size of the potentially affected area. All these factors are summarized in Tables 2-12 and 2-13.

As summarized in Tables 2-12 and 2-13, none of the concentrations detected in the soil remaining at Site 3/44 present an unacceptable risk to the environment and after risk management considerations these concentrations are not considered significant enough to warrant additional remediation.

2.8 DOCUMENTATION OF SIGNIFICANT CHANGES

The selected remedy was also the preferred alternative in the Proposed Remedial Action Plan, which was presented to the public at the public meeting held August 9, 2000.

There were no changes to the preferred remedial action alternative in the Proposed Plan.

TABLE 2-12

ECOLOGICAL RISK MANAGEMENT SUMMARY FOR PREDESIGN SAMPLE PCOCs
NSWCDL, DAHLGREN, VIRGINIA

Chemical	EPA Region 3 Screening Level Surface Soil (mg/kg)	Pre-Design Samples Maximum Hit (mg/kg)	Background Data for Surface Soil (mg/kg)	NOTES
Metals and Inorganic Compounds				
Aluminum	1	15,400	2,720 - 18,800	does not accumulate in plants and animals at normal pH
Antimony	0.48	0.73	NA	small area (0.27 acres) potentially affected
Beryllium	0.02	0.37	0.23 - 1.2	within background range
Chromium	0.0075	19.0	3.7 - 17.0	comparable to background
Cyanide	0.005	0.48	NA	less than EPA Region 4 screening level of 0.9 mg/kg
Iron	12	31700	1,980 - 14,700	does not accumulate in plants and animals at normal pH
Lead	0.01	24.3	8.6 - 20.8	within background range
Mercury	0.058	0.12	0.07 - .07	mean concentration (0..02) below screening value
Nickel	2	6.7	0.89 - 16.4	within background range
Selenium	1.8	2.5	0.74 - 0.79	mean concentration (1.29) below screening value
Silver	0.0000098	0.36	NA	less than EPA Region 4 screening level of 2 mg/kg (Region 3 Screening Value applicable to plants only)
Vanadium	0.5	31.4	7.3 - 33.4	within background range
Zinc	10	31.2	7.3.- 39.1	within background range

NA - None Available

TABLE 2-13

ECOLOGICAL RISK MANAGEMENT SUMMARY FOR VERIFICATION SAMPLE PCOCs
NSWCDL, DAHLGREN, VIRGINIA

Chemical	EPA Region 3 Screening Level Surface Soil (mg/kg)	Verification Soil Samples Maximum (mg/kg)	Background Data for Surface Soil (mg/kg)	NOTES
Semivolatile Organic Compounds				
Phenanthrene	0.1	0.13	NA	less than 2 times screening value
Pyrene	0.1	0.16	NA	less than 2 times screening value
Metals and Inorganic Compounds				
Aluminum	1	5,490	2,720 - 18,800	does not accumulate in plants and animals at normal pH
Beryllium	0.02	0.16	0.23 - 1.2	within background range
Cadmium	2.5	14	0.12 - 0.14	small area (0.27 acres) potentially affected
Chromium	0.0075	8	3.7 - 17.0	within background range
Copper	15	21.5	1.9 - 3.7	less than 2 times screening value
Lead	0.01	8.7	8.6 - 20.8	within background range
Iron	12	6,740	1,980 - 14,700	does not accumulate in plants and animals at normal pH
Nickel	2	4.2	0.89 – 16.4	within background range
Vanadium	0.5	12.3	7.3 - 33.4	within background range
Zinc	10	16.4	7.3.- 39.1	Within background range

NA - None Available

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3.0 RESPONSIVENESS SUMMARY

No written comments, concerns, or questions were received by the Navy, USEPA, or the Commonwealth of Virginia during the public comment period from July 20, 2000 to September 2, 2000. A public meeting was held on August 9, 2000 to present the Proposed Plan for Site 3/44 soils and groundwater and to answer any questions on the Proposed Plan and on the documents in the information repositories. A 30-minute presentation and question/answer period was provided. No questions were asked.

A transcript of the public meeting is provided in Appendix B.

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APPENDIX A

VIRGINIA CONCURRENCE LETTER

COMMONWEALTH of VIRGINIA

James S, Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
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Fax (804) 698-4500 TDD (804) 698-4021
http://www.deq.state.va.us

Dennis H. Treacy
Director

(804) 698-4000
1-800-592-5482

September 28, 2000

Mr. Abraham Ferdas, Division Director
Hazardous Site Cleanup Division (3HS00)
U.S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Re: Record of Decision for Site 3/44, Naval Surface Warfare Center, Dahlgren, Virginia

Dear Mr. Ferdas:

The Virginia Department of Environmental Quality staff has reviewed the Record of Decision (ROD) for site 3/44, Ordnance Burn Structure/Rocket Motor Pit, at the Naval Surface Warfare Center, Dahlgren, Virginia. We concur with the selected remedial alternative as outlined in the ROD dated September 2000.

Should you have any questions concerning this letter, please feel free to contact Dave Gillispie at (804) 698-4209.

Very truly yours,

Erica A. Dameron

Erica S. Dameron
Director, Office of Remediation Programs

cc: Ryan Mayer, ChesDiv
Ann Swope, NSWC Dahlgren
Bruce Beach, EPA Region III
Karen Jackson Sismour, VDEQ
Jon Terry, VDEQ NRO
Durwood Willis, VDEQ
Dave Gillispie, VDEQ

APPENDIX B

PUBLIC COMMENTS

NAVAL SEA SYSTEMS COMMAND

NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION

PUBLIC MEETING

WEDNESDAY, AUGUST 9, 2000, 7:00 P.M.
KING GEORGE COUNTY COURTHOUSE
KING GEORGE, VIRGINIA

PROPOSED REMEDIAL ACTION PLAN
Site 10, Hideaway Pond
Site 3, Ordnance Burn Structure
Site 44, Rocket Motor Pit

USEPA Region III
Hazardous Site Cleanup Division
Federal Facilities Section
Mr. Bruce Beach
1650 Arch Street, Philadelphia, Pennsylvania 18107

Virginia Department of Environmental Quality
Mr. David Gillispe
629 East Main Street, Richmond, Virginia 23219

Public Affairs Office
Commander, Naval Surface Warfare Center
Ms. Jennifer Wilkins
17320 Dahlgren Road, Mail Code CD06, Dahlgren, Virginia 22448

Reported by: Lola Gail Serrett

August 9, 2000:

CAPTAIN WILLIAM SNYDER: I'm not going to get up front and do a big speech, but it's nice to have at least some turnout from the county interested in what we do over there at Dahlgren. We do a lot of good work trying to restore what the Navy showed a little bit of neglect in the past decades. Bill and his group have worked with some of our contractors and technical people to try to restore and recover some of the things done earlier. As everybody else in the government is aware, our budget is certainly shrinking as we speak, but we learn to work smarter, not harder, and use our available assets in a wiser manner.

So, as a great Naval officer said, what time is the seven o'clock meeting suppose to start? It's seven o'clock, so we're going to start. And I ask throughout, since we have such a small crowd, any questions as we go, please speak up and we'll answer them on the spot or get you an answer, certainly, before the end of the week

if we have an e-mail or a phone number, whatever we need to do. Plenty of handouts in the back if anybody needs them. And with no further ado, I'll turn it over to our environmentalists. Enjoy.

MR. RYAN MAYER: Good evening. My name is Ryan Meyer. I'm the Remedial Project Manager for Dahlgren. Tonight, we have a public meeting. We'll be presenting two of our proposed remedial action plans. These two plans actually have three sites; 3/44 is one of the proposed plans; and Site 10, Hideaway Pond, is the second. We'll be presenting a summary of –- sort of a synopsis of these sites tonight. We advertised these two proposed plans in The Free Lance Star and Westmoreland News. We have a public comment period that started July 20th through August 19th for Site 10. Site 10 is a thirty day public comment period. In the same newspapers, we also advertised Site 3/44, starting July 20th through September 2nd. These sites have a forty-five day public comment period.

We'll answer any questions tonight that you all have. If you have any written comments you'd like to submit, on the information sheets, there's some point of contacts on the ninth page there, which has got some point of contacts and phone numbers to submit comments to. There's also more detailed information. We did bring some reports tonight, but the majority of our reports are in our administrative record and in the back of the proposed plans are three locations where you can review the reports.

We do have a court reporter here tonight. Because it's a public meeting, we'll be recording everyone's comments, our presentation. If you have a question that you'd like to ask during the presentation, feel free to ask it. We do ask that you give your name before you ask questions so we can record it.

So, without further ado, I'll turn it over to Dave Misenhimer. Dave is on our contract team. He's been performing a lot of these

investigations and designs for Dahlgren. His firm also helps to oversee of the contractors during the construction part, as well. Dave.

MR. DAVE MISENHIMER: Okay. Can we turn this machine on? As Ryan said, there's two proposed plans that are in the back of the room. You can pick them up. We've got plenty of them available for everybody. One deals with Site 10 and the other deals with Site 3/44. There are also handouts that are basically copies of the slides that you'll see presented through my presentation so you can follow along with the slides. And my presentation is not designed to be a lot of detail, but if you have any questions or you want further detail, I'll be happy to give more detail. So, as Ryan had said, jump in any time you have a question or comment. Okay.

CAPTAIN WILLIAM SNYDER: Can you still see your notes?

MR. DAVE MISENHIMER: Yeah. Is that okay for everybody? Okay. We'll start out with

Site 3/44 and, basically, 3/44 is a combination of two sites and the reason we combined them is because they are located very close to each other and the types of activities that occurred there were very similar. Site 3 is known as the Ordnance Burn Structure and Site 44 Rocket Motor pit. This map is also in the proposed plan and it shows the location of Site 3/44 being here on Mainside.

Also, there's another site just north of Site 3/44, known as Site 12. The reason I point that out is that that's a site that is currently being remediated. The soil and groundwater is being remediated and has been under remediation for the last couple of years and the contaminants that are of concern there are degreasers. These are chemicals that were used to degrease -- remove grease from machinery and were placed on Site 12 to ignite other materials that were burned there.

At Site 3/44, the types of activities that occurred there were -- at Site 3, it

was basically burning explosives and waste products that were related to the development of the explosives. And these materials were wastewater treatment sludges and spent carbon that was used in treating wastewater contaminated with explosives. These materials were burned on what are called burn pans, which were placed either on the surface of the soil or in steel boxed.

Site 44 an area where waste rocket motors were burned and Site 44 is a pit about five feet deep –- at least, it was -- about five feet deep and a width of twenty-four feet by thirty-six feet in length. Around the sides and ends of the pit were steel plates and, as I said, rocket motors, the propellant in the rocket motors was burned in those pits.

In 1998, there was a removal action completed and that basically consisted of removing soil that had been contaminated by these operations. As you can see on this aerial photo that –- also a proposed plan –- there's a silt

fence, here, outlined. Within this silt fence is the area where soil was removed that had been contaminated by –- contaminated as a result of past operations. It covers approximately a half acre area and the depth of soil that was excavated varied from –- anywhere from six inches to twenty-four inches. A total of twenty-one hundred tons of soil was removed from this area.

As you can see from the aerial photo, this area is pretty flat. Over here to the west is Gambo Creek. It’s about four hundred feet to the west of Site 3/44. The area within the silt fence is now grass covered. The area outside is pretty much brush. Groundwater in this area, surficial groundwater is about five to ten feet below the surface. The surficial aquifer is about twenty feet in thickness. And below the surficial aquifer is a clay layer, which prevents any of the surficial aquifer –- the groundwater from percolating into aquifers that are used for drinking water in the area. This surficial aquifer generally

flows in south southwesterly direction toward Gambo Creek.

When the soil was removed, there were certain contaminants that were associated with that soil. These are listed here; aluminum, arsenic, iron, nickel, magnesium –- I should say manganese –- and vanadium. When the removal action was completed, samples were taken of the soil that remained and tested for these metals, as well as several –- quite a few others, and compared to residential health based numbers, which are determined to be safe levels for these contaminants, and it was found that, after the soil was removed, there was no human health risk that was – that it was an acceptable human health risk.

Also, groundwater was tested at this site and analyzed for a whole host of potential contaminants and those contaminants were then evaluated in a human health risk assessment, as well, and it was determined that, although the groundwater is contaminated, the contaminants are

not coming from Site 3/44; rather, the contamination that is in the groundwater is from the adjacent site I mentioned earlier, Site 12, where you've got degreasing chemicals in the groundwater.

In addition to looking at human health risks, ecological risks or potential ecological risks evaluated and, in all cases, were found to be acceptable for the soil and groundwater. Based on that analysis, it was determined that our preferred alternative would be to have no further action both -– for both, the soil and the ground-water.

And that's pretty much my presentation in these sites, Site 3/44. If there are questions, I'd be glad to entertain them right now. Okay. No questions.

Let me go to my next slide show here. The next site I'm going to talk about is Site 10, known as Hideaway Pond. Hideaway Pond is also located within Mainside, up here in the northern portion of Mainside. It is also located near a site

known as Site 17, the 1400 Area Landfill, which is also undergoing remediation as we speak. In the case of Site 17, the landfill is being covered and provisions are being made to prevent any contaminants that may be present at Site 17 from being released. And one of the contaminants that is of particular concern is potential movement of mercury from Site 17 to groundwater and surface water into Hideaway Pond.

In looking at this aerial, there are tributaries, two tributaries that feed into Hideaway Pond, which flow past Site 17. Ultimately, Site 10 discharges to a stream which goes into Gambo Creek and, ultimately, to the Potomac River, which is about a mile downstream. Site 10 was originally created –- the pond was originally created in 1953 and then expanded in the early 1980s. It’s currently a fifteen acre pond. It encompasses an area of about twenty-five hundred feet long and the width varies anywhere from three hundred to five hundred feet.

In 1980, there was an anonymous report to the Navy that there may be mercury in the fish. Subsequently, the Navy sampled the fish and they did detect mercury in the fish. After sampling on a couple of other occasions, they decided it would be wise to implement a catch-and-release program. And that was implemented in 1983; has been in place since then. What that does is they post signs around the pond warning people that the fish may be contaminated and that you should not take them home and eat them; rather, you should just throw them back in the pond. And, again, early on, Site 17, the 1400 Area Landfill, was thought to be a potential source.

This next aerial photograph is also in the proposed plan and Site 10, the original pond, is this area, here. There's the original dam, the old dam. The new dam is located here to the south and this is the new portion –- or newer portion of the pond. One tributary comes up here, it flows past Site 17 on the east. Second tributary

comes up in this direction and flows past Site 17 on the west. This picture of Hideaway Pond was taken by standing on the new dam and looking north, so you can get an idea of what it looks like.

In evaluating Site 10, mercury in fish has been the major concern and since the early 1980s, the Navy has been collecting fish samples and analyzing them for mercury. And over the years, it has become evident that the levels of mercury in the fish is declining. Consequently, when we looked at the potential risks –- again, we looked at human health risk and ecological risks –- and came up with alternatives, it was determined that it appears the mercury concentrations are declining. We expect within the next five years or so that the mercury levels will be within acceptable levels in terms of human health risks and ecological risks; therefore, the preferred alternative is to continue with the catch-and-release program to prevent people from eating the fish until we’re sure the concentrations of mercury in the fish are

acceptable; and to continue monitoring the fish to make sure what has been occurring continues to occur and we do get to that point where the risks is negligible.

So, in a nutshell, what we're saying is the preferred alternative is to continue with the catch-and-release program, keep the signs posted around the pond to warn people not to eat the fish, monitor the fish to insure that the concentrations of mercury continue to decline and reach a point where it is an acceptable concentration and make sure that all these requirements are maintained until we get to that point via institutional controls. That's my presentation on Site 10. Are there questions about Site 10?

MR. BOB FESCALDO: I think –- I might have missed it, but I think –- what are the levels of mercury in the water there now?

MR. DAVE MISENHIMER: The levels of mercury in the water –- basically, what we looked at are what are acceptable in terms of water quality

and our levels in the pond were on order of magnitude more of –- or more than on order of magnitude less than those levels. We're talking very low levels, which are point one two parts per trillion, I think is the number. I'd have to look that up.

MR. RYAN MAYER: But it's on order of magnitude under the requirements.

MR. BOB FESCALDO: How about in the water? Is there more concentrated stuff in the muck?

MR. DAVE MISENHIMER: There, again, we looked at the sediment –- I assume that's what you're talking about?

MR. BOB FESCALO: Yes, the muck.

Mr. DAVE MISENHIMER: And, again, we do have criteria that we looked at to determine whether or not it's a concern and, again, it was below those criteria. And that was the reason why the alternative that was preferred here is not to muck around in the sediment and stir up whatever

might be there and do something in that way.

MR. BOB FESCALDO: And how often –- how often do you analyze the water samples and the sediment samples?

MR. RYAN MAYER: Well, in the past, we've probably gone through multiple rounds of sampling surface waters. Generally, in the past, though, they've analyzed for mercury in fish almost every year for the past ten years, maybe. The levels that we're getting in the sediment and the surface water are so low –- in fact, they're –- I believe they're below the screening criteria. And if it weren't for the fact that we had all this monitoring –- or this fish monitoring data, we probably wouldn't be doing this study at all. So, there's something going on in the system there that the fish are accumulating mercury.

MR. BOB FESCALDO: Yeah. What I –- what I was trying to get at is, you know, if you take samples from the sediment and things –- in the water, do they stay the same or are they going down?

You know, you don't have additional contaminants coming in? That's what I was getting at. Is there –- there's no additional contamination coming in there. Is that an accurate statement?

MR. RYAN MAYER: The mercury that we're finding in Hideaway Pond, we're tracking from, basically, Site 17. You can just see a mercury trail up to that landfill. And on the east –- as Dave was saying, there's an eastern and western tributary. The eastern tributary is where most of that mercury –- at least, the remnants of it seem like they're coming from. Since we're involved with remediation on that site now, we expect the mercury –-

MR. BOB FESCALDO: (interjecting) You're not noticing any increases in Hideaway Pond from whatever source?

MR. RYAN MAYER: Right.

MR. BOB FESCALDO: That's, kind of, all of I'm getting at here. At this point –- that's fine. Because the –- Hideaway Pond is –- has the

potential to be a concentrator of stuff. Okay. And that's, kind of, what I'm looking at. It's not concentrated there? You know, you're doing good things, making progress and all that good stuff. And that's it. Biological systems concentrate mercury and a whole bunch of other things, heavy metals, you know, all those kinds of things. But it's one of the –- one of the things you worry about if you're putting fertilizer down, you know, on fields out there.

CAPTAIN WILLIAM SNYDER: Does it do any good to know how long a fish has been in the water and then check his mercury level? Maybe get a little bit more accurate reading?

MR. RYAN MAYER: We'll in our monitoring that has been done to date, we don't necessarily do that, but what we do is we look at different size fish and that –-

CAPTAIN WILLIAM SNYDER: (inter-jecting) What I was going to say or what I was leading to was if we were to stock a certain

quantity of fish that we were tagged with particular numbers and tell anybody who catches a tagged fish turn it in for a five dollar reward, we know exactly when that fish entered the water and know what exactly what his mercury level was over a specific period of time, I think your data would be a lot more worthwhile.

MR. RYAN MAYER: Well, one thing that we've noticed in tracking the weight, species and concentration of mercury is that the tables are pretty linear in terms of concentrations of mercury and the size of the fish; especially in bass. I mean, it's almost linear. So, if you have certain size bass that you catch, you can pretty much figure out what the mercury concentration is going to be. And as it gets larger, it's going to be a lot less. So, from all those years of data, we can pretty much figure out what the levels are going to be in certain sizes of fish.

MR. BOB FESCALDO: You say it's ten years of data?

MR. RYAN MAYER : It’s ten years of data.

MR. BOB FESCALDO: You started –- it was first detected in 1980.

MR. RYAN MAYER: Well, actually, there’s about twenty years of data. What we’ve been looking at in particular are the last ten because we know, in the early 90s, the fish –- the pond was drained and a lot of the fish went downstream as a result of draining the pond. So, the data that has been accumulated since that occurred is really what we’re focusing on. And that’s, like, about ten years worth of data. But the Navy has been taking samples since the early 80s almost on a yearly basis.

MR. BOB FESCALDO: Do we have any idea, between Site 17 and Site 10, how much of that is getting any further than –-

MR. RYAN MAYER: You mean going further downstream? Well, we did test water beyond the pond and we did detect some there, but, again,

as you go further down the stream from Site 17, the levels trail off tremendously. And as I said earlier, there's criteria that you go by in evaluating whether or not there's a concern and once you get below Site 17 –- maybe I can show you that in this aerial photograph. We took samples along this tributary and along this tributary and we gridded the pond off and took numerous samples in the pond and then we took some samples down here, downstream of the spill-over.

What we found was, along this tributary, here, close to Site 17, the landfill, we were exceeding those criteria slightly. Once you got down to this area, here, just north of the pond, we were below the criteria and once we were in the pond, we were below the criteria and that follows downstream. So, there was an obvious tailing off of the concentration in the surface water. On this other tributary, we never did exceed the criteria. But again, the pattern was the same.

So, that's why we suspect that

there's still some residual mercury being released from that –- from the landfill at Site 17 and that's why our remedial action is designed the way it is; is to contain that and prevent any additional mercury from being released here and getting the surface water concentrations all along Site 17 below that criteria.

MR. DAVE MISENHIMER: Any other questions? Comments?

MR. BOB FESCALDO: The conclusion I draw is that we really don't have to worry about further contamination?

MR. DAVE MISENHIMER: Right.

MR. BOB FESCALDO: I mean, anything beyond those sites?

MR. DAVE MISENHIMER: Right.

MR. BOB FESCALDO: That's the bottom line?

MR. DAVE MISENHIMER: Yes

MR. BOB FESCALDO: Okay.

MR. DAVE MISENHIMER: Any further

questions? I'll turn it over to Ryan.

MR. RYAN MAYER: All right. Well, this pretty much concludes the public meeting. If there are any written comments that anyone has, as I said, in the proposed plan, there are point of contacts for people; Public Affairs here at the base, Dahlgren; EPA Region III; and then, the Department of Environmental Quality. Those are point of contacts if you have questions or if you want to submit written comments. Like I said, Site 10, the comment period goes from July 20th through August 19th. Site 3/44, the public comment period goes from July 20th through September 2nd, so there's still time to submit written comments. Any other questions?

Captain, do you want to say anything?

CAPTAIN WILLIAM SNYDER: Nobody has any comments or questions?

MR. BOB FESCALDO: Nothing they want to put on the record.

CAPTAIN WILLIAM SNYDER: All this happened on his watch, by the way. I'd just like to thank Billy and Dave and Ryan. You guys do great work and you present it very well. They say it's not rocket science, but some of it actually is and there are new innovations every day that –- to restore the environment and make it as pristine and unmolested as possible. So, we take it very seriously, obviously, and if you go by the base now, you'll see an awful lot of trucks moving out of there. You've got 1400 there that we mentioned. And if it's damaged at all, we're going to clean it up and make it right.

Those of you who have been coming to meetings for a while, if you go back and see some of the sites that we restored over the past few years, you'll just be amazed at what the eastern shore of Gambo Creek looks like below Middle Bridge and the area there next to 44 where we restored an area where it was just easier to cover it with topsoil and reseed it and make it whole again. It's

a lot prettier than it was before and the animals and critters certainly are prospering, so it's a lot of work. Seems like a lot of construction, but in the end game, it pays off.

So, we're cleaning the place up and we're trying to do it methodically and smartly, with the funds we have and we're going to continue doing it. I'd like to see them stock more fish so we catch more.

MR. BOB FESCALDO: One of my comments was going to be –- I like the proposal because that means we're getting closer to catch-and-eat.

CAPTAIN WILLIAM SNYDER: We're making real strides. What we do here with the environment is just –- if you take home a old 1920's automobile, if you don't fix it up and restore it or maintain it, it's junk; if you do maintain it, it's a thing of beauty. So, that's the way with some of these historical things; if you don't take care of them, then we're not going to have them. We're in a big push right now to just clean up and modernize the

base, so I think over the next months and years, you'll see we continue to do that to the benefit of the environment. It's a long term project. We're going to make big strides. Again, thank you everybody.

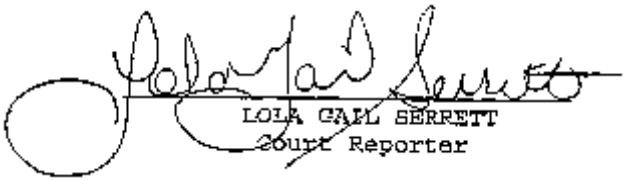
HEARING CONCLUDED AT 7:32 P.M.

CERTIFICATE OF COURT REPORTER

I, Lola Gail Serrett, hereby certify that I was the Court Reporter at the Public Meeting held at King George Courthouse, King George, Virginia, on August 9, 2000, at the time of the meeting herein.

I further certify that the foregoing transcript is a true and accurate record of the proceeding herein.

Given under my hand this 27th day of August, 2000.



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APPENDIX C

TOXICITY PROFILES

APPENDIX C TOXICITY PROFILE

2-AMINO-4,6-DINITROTOLUENE

Aminodinitrotoluenes are related to high exposives used in military armaments and have been reported to have formed from the degradation of 2,4,6-trinitrotoluene (TNT). They vare absorbed through the gastrointestinal tract, skin, and lungs and are distributed primarily to the liver, kidneys, lungs, and fat and are excreted mainly in the urine and bile. In animals, signs of acute toxicity include ataxia, tremors, and mild convulsions.

The reference dose (RfD) for chronic oral exposures to aminodinitrotoluenes is 6.0E-05 mg/kg/day (USEPA National Center for Environmental Assessment, April 2000).

Aminodinitrotoluenes are not classified as to their carcinogenicity.

ARSENIC

Noncancer Toxicity

The toxicity of inorganic arsenic (As) depends on its valence state (-3, +3, or +5), and also on the physical and chemical properties of the compound in which it occurs. Trivalent (As+3) compounds are generally more toxic than pentavalent (As+5) compounds, and the more water soluble compounds are usually more toxic and more likely to have systemic effects than the less soluble compounds, which are more likely to cause chronic pulmonary effects if inhaled. One of the most toxic inorganic arsenic compounds is arsine gas (AsH3). It should be noted that laboratory animals are generally less sensitive than humans to the toxic effects of inorganic arsenic. In addition, in rodents the critical effects appear to be immunosuppression and hepato-renal dysfunction, whereas in humans the skin, vascular system, and peripheral nervous system are the primary target organs. Water soluble inorganic arsenic compounds are absorbed through the G.I. tract (>90%) and lungs; distributed primarily to the liver, kidney, lung, spleen, aorta, and skin; and excreted mainly in the urine at rates as high as 80% in 61 hr following oral dosing. Pentavalent arsenic is reduced to the trivalent form and then methylated in the liver to less toxic methylarsinic acids. Symptoms of acute inorganic arsenic poisoning in humans are nausea, anorexia, vomiting, epigastric and abdominal pain, and diarrhea. Dermatitis (exfoliative erythroderma), muscle cramps, cardiac abnormalities, hepatotoxicity, bone marrow suppression and hematologic abnormalities (anemia), vascular lesions, and peripheral neuropathy (motor dysfunction, paresthesia) have also been

reported. Oral doses as low as 20-60 g/kg/day have been reported to cause toxic effects in some individuals. The acute lethal dose to humans has been estimated to be about 0.6 mg/kg/day.

General symptoms of chronic arsenic poisoning in humans are weakness, general debility and lassitude, loss of appetite and energy, loss of hair, hoarseness of voice, loss of weight, and mental disorders. Primary target organs are the skin (hyperpigmentation and hyperkeratosis), nervous system (peripheral neuropathy) and vascular system. Anemia, leukopenia, hepatomegaly, and portal hypertension have also been reported. In addition, possible reproductive effects include a high male to female birth ratio. In animals, acute oral exposures can cause gastrointestinal and neurological effects. Oral LD50 values range from about 10 to 300 mg/kg. Low subchronic doses can result in immunosuppression and hepatorenal effects. Chronic exposures have also resulted in mild hyperkeratosis and bile duct enlargement with hyperplasia, focal necrosis, and fibrosis.

The Reference Dose for chronic oral exposures, 0.0003 mg/kg/day, is based on a NOAEL of 0.0008 mg/kg/day and a LOAEL of 0.014 mg/kg/day for hyperpigmentation, keratosis, and possible vascular complications in a human population consuming arsenic-contaminated drinking water. Because of uncertainties in the data, U.S. EPA states that “strong scientific arguments can be made for various values within a factor of 2 or 3 of the currently recommended RfD value.” The subchronic: Reference Dose is the same as the chronic RfD, 0.0003 mg/kg/day.

Acute inhalation exposures to inorganic arsenic can damage mucous membranes, cause rhinitis, pharyngitis and laryngitis, and result in nasal septum perforation. Chronic inhalation exposures, as occurring in the workplace, can lead to rhino-pharyno-laryngitis, tracheobronchitis, dermatitis, hyperpigmentation, hyperkeratosis, and peripheral nerve dysfunction as indicated by abnormal nerve conduction velocities and peripheral vascular disorders as indicated by Raynaud's syndrome and increased vasospastic reactivity in fingers exposed to low temperatures. Higher rates of cardiovascular disease have also been reported in some arsenic-exposed workers. Possible reproductive effects include a high frequency of spontaneous abortions and reduced birth weights. Arsine gas (AsH3), at concentrations as low as 3-10 ppm for several hours, can cause toxic effects. Hemolysis, hemoglobinuria, jaundice, hemolytic anemia, and necrosis of the renal tubules have been reported in exposed workers. Subchronic and chronic RfCs for inorganic arsenic have not been derived.

Carcinogenicity

Epidemiological studies have revealed an association between arsenic concentrations in drinking water and increased incidences of skin cancers (including squamous cell carcinomas and multiple basal cell carcinomas), as well as cancers of the liver, bladder, respiratory and gastrointestinal tracts. Occupational exposure studies have shown a clear correlation between exposure to arsenic and lung cancer mortality

has placed inorganic arsenic in weight-of-evidence group A, human carcinogen. The oral slope factor for arsenic is 1.5 $(mg/kg/day)^{-1}$. For inhalation exposures, a slope factor of 15.1 $(mg/kg/day)^{-1}$ has been derived.

1,1-DICHLOROETHYLENE

1,1-Dichloroethylene (CAS No. 75-35-4), also known as 1,1-dichloroethene and vinylidine chloride, is a colorless liquid that is used primarily in the production of polyvinylidine chloride (PVC) copolymers and as an intermediate for synthesis of organic chemicals. The major application for PVC copolymers is the production of flexible films for food packaging such as Saran**7** wrap. 1,1-Dichloroethylene does not occur naturally but is found in the environment due to releases associated with its production and transport and with the production of its polymers. Because of its high volatility, releases to the atmosphere are the greatest source of ambient 1,1-dichloroethylene. Smaller amounts are released to surface waters and soils. Loss of 1,1-dichloroethylene from water and soils is primarily due to volatilization. In the atmosphere, reaction with photochemically generated hydroxyl radicals is expected to be the predominant removal mechanism. Human exposure to 1,1-dichloroethylene is potentially highest in workplace settings and in the vicinity of hazardous waste sites where the compound may contaminate environmental media.

Noncancer Toxicity

The primary effect of acute exposure to high concentrations (approximately 4000 ppm) of 1,1-dichloroethylene vapor in humans is central nervous system (CNS) depression which may progress to unconsciousness. Occupational exposure has been reported to cause liver dysfunction in workers 1,1-Dichloroethylene is irritating when applied to the skin and prolonged contact can cause first degree burns. Direct contact with the eyes may cause conjunctivitis and transient corneal injury. In experimental animals, the liver and kidneys are target organs for the toxic effects of 1,1-dichloroethylene. Subchronic oral exposure for 90 days to 1,1-dichloroethylene in drinking water produced slight hepatotoxic effects at 200 ppm and chronic oral exposure to drinking water for 2 years produced hepatocellular changes in males at >=100 ppm and in females at >=50 ppm. Gavage administration of 10 mg/kg/day, 5 days/week for 2 years produced chronic inflammation of the kidney in male and female rats and liver necrosis in male and female mice. Exposure by inhalation to 55 ppm 1,1-dichloroethylene, 6 hours/day, 5 days/week for up to 1 year produced fatty liver changes in rats and focal degeneration and necrosis in mice. In a three-generation study, no treatment-related effects on reproduction or neonatal development were seen in male and female Sprague-Dawley rats administered up to 200 ppm of 1,1-dichloroethylene in the drinking water. However, inhalation exposure during gestation produced increased resorptions and minor skeletal alterations in rodents at concentrations that caused maternal toxicity. These effects were reported in rats and mice at >=15 ppm and in rats and rabbits at >=80 ppm and >=160 ppm, respectively. An oral Reference Dose (RfD) of 9E-3 mg/kg/day was derived for chronic exposure and subchronic exposure to

1,1-dichloroethylene, based on liver lesions seen in rats in a 2-year drinking water study. The oral RfD is currently under review and may be subject to change. An inhalation Reference Concentration (RfC) for 1,1-dichloroethylene is under review.

Carcinogenicity

An epidemiology study using a small cohort found no association between the occurrence of cancer or cancer mortality and exposure to 1,1-dichloroethylene. Oral carcinogenicity bioassays (drinking water or gavage exposures) with experimental animals gave generally negative results. In one inhalation study, statistically significant increases in renal adenocarcinomas were noted in male Swiss mice exposed to 25 ppm for 12 months. Also observed were statistically significant increases in mammary gland carcinomas in females and lung tumors in both sexes. Results of other inhalation studies with rats, mice, and hamsters have been negative. Based on EPA guidelines, 1,1-dichloroethylene was assigned to weight-of-evidence group C, possible human carcinogen. For oral exposure, the slope factor is 6E-1 $(mg/kg/day)^{-1}$ and the unit risk is 1.7E-5 $(ug/L)^{-1}$. The inhalation slope factor is 0.175 $(mg/kg/day)^{-1}$.

RDX (ROYAL DEMOLITION EXPLOSIVE; HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE)

Pharmacokinetic

Although RDX is not readily absorbed through the skin (U.S. EPA, March 1994), oral exposure studies indicate that RDX is rapidly absorbed (U.S. EPA, 1988b). According to observed ingestion and inhalation exposures, evidence exists that this man-made compound is absorbed in the GI tract and may be absorbed in the lungs. However, GI absorption of RDX is regarded as poor (U.S. EPA, 1988b).

Limited studies are available concerning the distribution, metabolites, and excretion of RDX. RDX is metabolized by the liver and excreted in the urine. According to one study (U.S. EPA, 1988b), RDX was detected in the urine 48 hours after oral exposure and in the feces 96 hours after exposure.

Noncancer Toxicity

RDX has been found to cause nausea, irritability, convulsions, unconsciousness, and amnesia in humans following oral and inhalation occupational exposure. The U.S. EPA (March 1994) derived a chronic oral RfD of 0.003 mg/kg/day for RDX from a NOEL of 0.3 mg/kg/day and an uncertainty factor of 100 (for extrapolation of animal doses to humans and uncertainty in the threshold for sensitive humans). This value is based on a 2-year rat feeding study performed by the U.S. DOD where notable critical effects were inflammation of the prostate and increased pigment in the spleen of male rats. Several chronic effects were observed for rats

exposed to high doses of RDX. They included increased mortality, hepatoxicity, increased incidences of cataracts in female rats, and behavioral hypersensitivity and renal toxicity in male rats. At a dose of 8 mg/kg/day, increased kidney weights were noted for both male and female rats. Embryonic and maternal toxicity was observed in rats exposed to RDX in developmental toxicity studies (U.S. EPA, 1988b).

Carcinogenicity

The U.S. EPA (March 1994) has classified RDX in the cancer weight-of-evidence Group C (possible human carcinogen). Although no epidemiological studies have been conducted on humans, data does exists which indicates that RDX is carcinogenic in animals. Hepatocellular adenomas and carcinomas were observed in female rats exposed to RDX in their diet. A drinking water unit risk of 0.0000031 per µg/L and an slope factor of 0.11 kg/day/mg was developed based on a U.S. DOD study (U.S. EPA, 1988b). It should be noted that this slope factor may not be applicable at water concentrations exceeding 3,000 mg/L.

1,1,1-TRICHLOROETHANE

1,1,1-Trichloroethane is absorbed via the inhalation, oral, and dermal exposure routes. After cessation of exposure, clearance of the chemical from the blood is rapid; 60 to 80% is eliminated within 2 hours, and greater than 95% is eliminated within 50 hours. A large fraction of the absorbed dose is excreted unchanged in exhaled air, regardless of route of exposure.

Noncancer Toxicity

The distribution of absorbed 1,1,1-trichloroethane is similar for all routes of exposure. The chemical has been detected in the fat, liver, lung, and muscle of humans and in the fat, liver, kidney, brain, muscle, and skin of animals. Humans and animals metabolize less than 10% of a dose of 1,1,1-trichloroethane regardless of the route of exposure; the major urinary metabolites are trichloroethanol and its glucuronide conjugate, trichloroacetic acid, and volatile carbon dioxide. These urinary metabolites are excreted slowly in comparison to the rate of expiration of 1,1,1-trichloroethane in the breath (elimination half-times, 10 to 27 and 70 to 85 hours, respectively), and may accumulate with repeated exposure, such as in the workplace. Few data were found for the oral toxicity of 1,1,1-trichloroethane. One case study reported gastrointestinal and hepatic effects in an individual who accidentally ingested approximately 600 mg/kg of the chemical. In animals, oral LD50 values range from 5660 mg/kg (rabbits) to 12,300 mg/kg (rats). Death in most cases has been attributed to central nervous system depression resulting from anesthesia. Chronic oral doses of 1500 mg/kg reduced body weight gain and increased the effects of aging in rats and reduced body weight gain and decreased survival in mice. No other effects were noted in either species. In both humans and animals, the first and primary response to acute, high concentrations of inhaled

1,1,1-trichloroethane is central nervous system depression. The chemical also can sensitize the heart to epinephrine at high levels but has little effect on other organs. Accidental exposures to concentrations ranging from 6000 to 20,000 ppm have been fatal to humans. The effects of subchronic and chronic Inhalation exposure to 1,1,1-trichloroethane are generally mild, characterized by growth reduction in guinea pigs (650 ppm) and minimal hepatic effects in mice and rats. At 1000 ppm for 7 hours/day, 5 days/week for 6 months, female guinea pigs had fatty liver changes and increased liver weights; the no observed adverse effects level was 500 ppm. Fatty liver in humans has been associated with exposure to 1,1,1-trichloroethane. One epidemiology study and several animal studies did not establish a relationship between exposure to 1,1,1-trichloroethane and adverse developmental or reproductive effects.

The subchronic and chronic oral RfD values for 1,1,1-trichloroethane were withdrawn from the Integrated Risk Information System database and from the Health Effects Assessment Summary Tables. A provisional chronic oral RfD of 0.02 mg/kg-day and a provisional chronic inhalation reference dose of 0.286 mg/kg-day has been developed by EPA-NCEA based on fatty liver changes in guinea pigs.

Carcinogenicity

No epidemiological data for 1,1,1-trichloroethane and inadequate carcinogenicity data for animals place the chemical in the United States Environmental Protection Agency's weight-of-evidence group D, not classifiable as to human carcinogenicity.

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